

GCES OFFICE COPY DO NOT REMOVE!

NEW DEBRIS FLOW AT LAVA FALLS RAPID

Lava Falls Rapid is, at all water levels, the most severe rapid in Grand Canyon. Its severity increased markedly in the early morning hours of March 6, 1995, when a debris flow from Prospect Creek constricted the Colorado River by approximately 50 percent. For Prospect Creek, the debris flow is the first since 1963 and the largest debris flow since 1955. The changes in Lava Falls Rapid are the most significant in Grand Canyon since the 1966 debris flow in Crystal Creek. There may be an increase in the number of boating accidents at Lava Falls.

The debris flow was witnessed by members of a Glen Canyon Environmental Studies (GCES) research trip who ironically were monitoring past debris flows in Grand Canyon. The GCES trip arrived at Lava Falls during the morning of March 4 and camped at the sand bar about a quarter mile above the rapid on river left. Work began immediately on repeat photography of historic photographs of the rapid. Although it had been cloudy with sporadic rain for nearly a week, March 4 was clear by noon. Rainfall began at midnight March 5. Light rainfall continued steadily the following day, but scientists matched photographs and collected data on the rapid and the source areas of historic debris flows. The storm culminated in steady hard rainfall that began about 6 PM and continued until after midnight. No thunder was heard during the storm, and no estimates were made of the total rainfall.

At midnight, March 6, several gusts of wind blew down the kitchen tarps and turned over tables. Several trip members got up to pick up items that could get wet and to stabilize the kitchen gear. After returning to bed, at approximately 12:30 AM, at least three members of the trip were startled by a roaring sound that came from the direction of Lava Falls Rapid. The exact time of the beginning of the sound is unknown but probably was between 1:00 and 1:30 AM. Part of the noise was identified as distinct rockfalls. Most of those that heard the roaring sound, including boatman Bob Gruzy, were concerned that the river was rising with storm runoff and that boats or the camp would be threatened. Bob Webb remembers that the noise lasted 3-5 minutes and then subsided, but others thought the sound lasted much longer.

At about 2:30 AM, Gruzy got up to find rising water and put extra lines on his boat. At about 4:00 AM, Mimi Murov rose to take down the wash table that was threatened by the rising Colorado River. The rainfall had stopped by this time. Murov thought the eddy was pooled up and calm; she thought at the time that the high water was not from a Colorado River flood but instead resulted from an increased constriction downstream.

Trip members rose at 6:00 AM on March 6 to clear skies and a river that was 3 to 4 feet higher than the previous night. The river appeared ponded with little movement. After cleaning up the wind-strewn equipment in the kitchen area, trip members hiked to the left scout of Lava Falls to view what we thought would be high water flowing through the rapid. Instead, at 7:00 AM, we saw the new debris fan and recessional floodwaters in Prospect Creek. Despite the passage of about 6 hours, the new debris fan was still changing from reworking by the Colorado River and recessional flow in Prospect Creek.

A 1,000-foot dark brown waterfall at the upper end of Prospect Canyon was jetting about 500-1,000 cubic feet per second of water into the creek channel. The waterfall sent a fine brown mist into the canyon. Flow in the creek was a dark chocolate brown, and boulders and cobbles could be distinctly heard rolling along the bed. The creek channel was too high to cross until about 3:00 PM, and flow in Prospect Creek stopped after dark on March 6. Storm runoff lasted 18-20 hours.

When we first saw it, the new debris fan extended into the river to about the left edge of the Ledge Hole. The new fan extended about 100-150 feet into the river over a distance of 600 feet. The fan sloped continuously into the river with no sign of a cutbank on its edge.

Photographic monitoring of the debris fan began immediately because floodwaters prevented us from getting on the new debris fan. As the morning progressed, the edge of the debris flow was cut away by about 20-24 feet, leaving an 8-foot high cutbank on the left side of the rapid. Photographers on the left side of the rapid saw large sections of the new fan fall into the rapid. Recessional flow in Prospect Creek cut two channels through the debris fan, further reducing its size. The floodwater entering on the left side contributed to the failures.

The rapid appeared markedly different on the morning of March 6. The entry water was extremely fast. Some well-known hydraulic features, such as the Ledge Hole and the V Waves, were still present but greatly increased in size. The right lateral of the V waves became much stronger than the left wave. The Ledge Hole had a different shape, a sharper drop, and a stronger hydraulic than before. The slot run was not apparent. Marker rocks, such as the Domer Rock (also known as Big Bertha) and the Meteor Rock, and their identifying waves and holes were not visible. The large waves that used to form between the V Waves and the Black Rock initially were very large but disappeared by the end of the day. A large, continuously breaking wave formed off of the Black Rock, and large whirlpools formed to the right of and behind the Black Rock. Floodwaters entering on the left eliminated any possibility of running left of the Ledge Hole. Boulders were heard rolling along the bottom above the sound of the rapid. Kenton Grua and Grusy both thought that initially the rapid was unrunnable.

Downstream, the former eddies on river left and right were replaced by fast-moving water. A secondary rapid formed at the Warm Springs, but its waves subsided to riffle size as the day progressed. We interpreted the secondary riffle as water flowing around and over a new island where the pool used to be; the size of the riffle probably changed as a gravel/cobble bar migrated downstream into Lower Lava Rapid. By the afternoon on March 6, a run developed just to the left of the Ledge Hole.

On March 7, trip members had full access to both sides of the rapid and Prospect Canyon. We had Sunday water through the rapid; although we no longer had any local indicators to tell us what the discharge might be, we guessed it was about 12,000 cubic feet per second. The debris fan did not change during the day. Most of the familiar features of the rapid, such as the slot run and the marker rocks, reappeared. The Ledge Hole remained slightly different and stronger than before. The breaking wave off the Black Rock was still present, and the secondary riffle remained small. The left run continued to develop and remained in a condition judged runnable. The rapid appeared much more energized than before; the former right run appeared more than likely to flip oar boats, and the wave off the Black Rock was strong enough to potentially flip motor rigs.

On March 8 and 9, normal fluctuating flows were observed in the rapid. We still could not determine the discharge from the stage in the vicinity of the rapid. The entire rapid had a much higher velocity. Both Grua and Grusy felt that the right side appeared as if the discharge were 4,000 cubic feet per second higher than it actually was. The entry to the right run is much faster, and the right side of the V Waves is much larger. Several large waves that previously formed between the V Waves and the Black Rock are no longer present, but the continuously breaking wave off the Black Rock persists. Grusy ran his 37-foot motorboat through the right run and stated the rapid was faster but may be easier because the Big Wave no longer exists. The left run consists of passing close to the left side of the Ledge Hole and then running a haystack wave and left of the Domer Rock and hole. Grua made the run easily in a 22-foot motor snout, although the speed of the water entering the run was measured to be 15 feet per second. Both boats came close to the Black Rock but easily missed it.

The debris-flow project had previously identified Lava Falls Rapid as the most unstable in Grand Canyon and was finalizing work on a paper on historic changes in the rapid. Because of the previously collected information, the new debris flow was easily interpreted in terms of

size and recurrence interval. The most recent debris flow at Lava Falls was in 1963; the 1995 debris fan exceeded the depositional area of the 1963 flow, and the 1995 debris flow eroded all the terraces deposited in 1963. The 1955 debris flow was larger; the 1995 debris flow did not exceed the stage of 1955 and created a smaller constriction. Therefore, the 1995 debris flow in Prospect Creek is the largest debris flow in 40 years and the first in 32 years.

The 1995 debris flow in Prospect Creek set several benchmarks in Grand Canyon history. The storm that spawned it was only the second winter storm since 1872 that is known to have created a debris flow (after December 1966). The debris flow is the second largest in Grand Canyon since closure of Glen Canyon Dam (after the Crystal Creek debris flow of 1966). Changes to Lava Falls Rapid are less than changes to Crystal Rapid in 1966 but are comparable with other recent debris flows, such as House Rock Rapid in 1966-1971 and Specter, 24-Mile, and Bedrock Rapids in 1969.

One other potentially significant change we observed was at 209-Mile Rapid. Granite Park Canyon had a flash flood that closed off the left channel around the island. The left lateral on the entry to 209-Mile Rapid is now stronger, which makes missing the hole on the right more difficult.

WITNESSES

John Elliott	Steve Eudaley	Bruce Finley	Peter Griffiths
Diane Grua	Kenton Grua	Bob Grusy	Mia Hanson
Marker Marshall	Ted Melis	Mimi Murov	Dominic Oldershaw
Steve Thamstrom	Meg Viera	Robert Webb	Tom Wise

GCES OFFICE COPY
DO NOT REMOVE!

